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(54) Title: ROOF AND WALL CLADDING

(57) Abstract

Pipe sections or external roof or wall cladding are formed of bonded man–made vitreous fibre batts wherein the fibres have a viscosity at 1400 °C of 10 to 170 poise and a dissolution rate at pH 4.5 of at least 20 nm per day.

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ROOF AND WALL CLADDING

This invention relates to bonded man-made vitreous fibre (MMVF) batts which are constructed for use as external roof or wall cladding or as pipe sections, i.e., insulation for fitting around pipes which may be internal or external.

Batts for external use are much more exposed to adverse conditions such as moisture, sun, temperature and wind than batts for internal use. The combination of moisture and heat can create an aggressive environment for the fibres, but conventional MMVF fibres, in conventional batt constructions, resist this. The exposure to wind can promote delamination, but sufficient structural strength can be provided by known techniques such as bonding with a bonding agent and by constructing the batt with the fibre direction predominantly perpendicular, as lamellar boards, instead of the conventional orientation of being substantially parallel to the face of the batt.

Similarly batts for internal or external pipe sections insulation are more exposed to humid conditions than batts for regular internal uses, especially when enclosed in an aluminium membrane or plastics membrane or other impermeable sheath.

More recently, there has been a trend to develop MMV fibres which have some degree of solubility in physiological fluids. Most of the publications on this topic of solubility emphasise the desirability of the fibres having some degree of solubility in physiological saline at pH around 7.5.

Fibres which, instead, have improved solubility at around pH 4.5 are described in WO96/14454 and WO96/14274.

A problem which arises with the use of MMVF batts made from fibres having appreciable solubility at near neutral pH (approximately pH 7.5) in roof or wall cladding is that the fibres are liable to degrade when exposed to atmospheric humidity for prolonged periods or when exposed

to condensation or direct contact with water. Accordingly it can be unsatisfactory to use such fibres for external roof or wall cladding, unless special precautions are taken to minimise this problem.

It would be desirable to be able to provide pipe sections external roof or wall cladding formed from MMVF fibres which are regarded as having good physiological solubility under relevant test conditions but which have less tendency to degrade when exposed to ambient humidity.

According to the present invention, we provide pipe sections or external roof or wall cladding which is a bonded MMVF batt wherein the fibres are formed of a composition which includes, by weight of oxides,

SiO_2	32 to 48%
Al_2O_3	10 to 18%
CaO	10 to 30%
MgO	2 to 20%
FeO	2 to 15%
$Na_2O + K_2O$	0 to 6%
TiO_2	0 to 6%
Other Elements	0 to 15%

and the composition has a viscosity at 1400°C of 10 to 70 poise, and the fibres have a dissolution rate of at least 20nm per day when measured at a pH of 4.5 (by the methods described in WO96/14274). Preferably they are relatively insoluble at pH 7.5

The invention includes the MMVF cladding batts themselves, their use as external wall or roof cladding in buildings and building components which are to be on the exterior of a building, and the buildings or building components themselves which include the defined MMVF batts. the invention includes the use of pipe sections for insulating pipes.

The building or building component generally comprises a metal, wood or other frame work on to which the MVVF batts are secured in a position such that they will be on the exterior of the building in use. The building may be

an entire building, but the invention also includes building components, for instance a roof structure or wall structure. For instance the roof or wall structure may constitute an entire roof or wall for a building or several such structures, each containing a plurality of batts, may be assembled on site to provide a roof or wall.

The cladding batt as initially manufactured (ie before leaving the plant where it is manufactured) or before installation in or on the building component or building is often provided with a substantially overall or impermeable coating on its external surface. This protective coating may be of water-repellant materials such as roofing felt or it may be of a foil or a decorative material such as paint. Even if such a coating is not applied before assembly, the external surface of the batt or batts in the building component or building are usually provided with a coating. For instance roof boards may be coated with roof felt, asphalt, wood plate, vlies, foil or solar heating units. The roof boards are preferably sufficiently stiff that one can walk on them. Wall cladding may be coated with plaster (either inorganic or organic), cement, paint, polyurethane, roof felt, foil (for instance aluminium), glass or solar heating units.

One type of cladding batt according to the invention is a very high density MMVF batt, typically having a density 500 to 2,000 Kg/m^3, often 700 to 1,200 Kg/m^3. This high density product usually carries a coating of paint or other substantially impermeable or overall surface covering. Other batts according to the invention may have lower density than this and can be roof boards or wall boards of more conventional construction.

The cladding batts of the invention usually have a density of at least 50 Kg/m^3 and often at least 70 Kg/m^3, typically up to 500 Kg/m^3. Batts of differing densities can be laid one upon the other in use, with the higher density batt usually on the outside.

Preferred cladding products of the invention have a multi-density construction, usually a dual density construction, with the MMVF layer which is on the outside of the building in use having a higher density than, and formed substantially integral with, the remainder of the MMVF batt. For instance the outer layer usual has a density of at least 60 Kg/m^3 and preferably at least 70 or 80 Kg/m^3, and often it has a density of at least 20 Kg/m^3, and frequently at least 50 Kg/m^3, above the density of the layer beneath it. The high density outer layer is usually at least 5 mm thick, often 10 to 40 mm thick and typically constitutes 2 to 30%, often 3 to 15 or 20%, of the total thickness of the MMVF batt.

The cladding batts are usually square or rectangular slabs but can have other, more complex, shapes, especially when they form parts of roofs. The batts generally have a thickness of 10 to 500 mm. The thicker batts are stiff and are provided as slabs but some of the thinner batts, for instance as facade or wall boards, may sometimes be supplied as a roll of sheet material.

The cladding batts and pipe sections are usually bonded by incorporation of conventional phenolic or other binder, typically in amounts of 1 to 5%, often 2 to 4%, by weight of the batt.

Water-repellent material may additionally be included in the cladding batts and pipe sections during manufacture in conventional manner, for instance an oil may be included to improve water-repellency. The total ignition loss of the batts is generally in the range 2 or 3% up to 5 or 6%.

The batts can be made by any of the conventional techniques known for making batts of the desired construction for description of suitable methods of making and using external MMVF wall and roof cladding and pipe sections, reference should be made to any or all of EP 133,083, 277,500, 420,837, 435,942, 518,964, 521,058, 560,878, 590,098 and 654,100, GB 1,027,799 and 2,223,248, DK 155,163 and DK-U3-9200033, DE-U1-29616962, DE 4,143,387,

4,319,340 and 4,432,866, and WO94/16162, 94/16163, 94/16164 and 95/20708, and WO89/07731, WO89/07733, WO96/37728 and WO97/01060. All these are herein incorporated by reference.

The fibres may be substantially parallel to the external face of the batt or the fibres may be substantially perpendicular to the face of the batt, the product then being of the type conventionally known as a lamellar batt or slab.

External roof cladding can have any of the normal configurations of roof boards or other roof cladding and generally has a density in the range 100 to 400, preferably 100 to 200, Kg/m^3 and a thickness of 10 to 500, usually 10 to 300 mm.

Single layer roof boards often have a density of 100-300kg/m^3 and a thickness of 10-300mm. Instead of using a single layer, several layers may be applied one on top of the other, for instance as a combination of lamellar and normal batts, but preferably with the outer layer having the highest density and/or being a lamellar batt.

Preferred roof cladding is formed of dual density batts. The density of the bottom may be 60-200kg/m^3 and the density of the top is usually at least 50kg/m^3 more and is usually 200-400 kg/m^3. The thickness of the bottom may be at least 15mm and the thickness of the top may be 100-300mm. The maximum total thickness is usually 350mm.

Wall cladding can be of two types. The first type is what is commonly known as a facade board. The other type of wall cladding is often known as a lamella board. The wall cladding generally has a density in the range 50 to 400, often 50 to 200 Kg/m^3, often around 50 to 150 Kg/m^3. For instance facade boards may have a density of around 70 to 150 Kg/m^3 whilst lamellar boards may have a density of 50 to 100 or 150 Kg/m^3. They may have a thickness typically of 10 to 300, often 10 to 200 mm.

Lamella boards can be made with lower densities compared to the normal single layer boards. Furthermore,

lamella boards can resist the influence of the wind (delamination strength), which can be a problem with normal single layer boards having the same density. Lamella boards normally have an impermeable surface coating, for instance of wood, foil, roofing felt or other substantially impermeable sheet material.

Typical facade boards have a width of 20cm or more, e.g., 60cm, and can typically have a length of 1-2 metres (e.g., 1.2m) but can be a roll (e.g., 10m). Roof boards usually have a width of above 50cm (e.g., 60cm or 120cm up to 150cm) and a length which is more (e.g., 90cm up to 300cm, e.g., 180 or 140cm).

Pipe sections are used for heating insulation, cooling insulation or condensing insulation around internal or external pipes and pipe fittings. Condensing insulation has a thickness or shape designed so that vapour condenses on the outer surface of the pipe section and/or so that condensed vapour is drained out of the pipe section in order to prevent corrosion of the pipes (see EP 739,470, WO94/05947; EP 528,936, WO97/16676).

The sections can be covered with impermeable aluminium foil or plates; paper coated with aluminium; metal plates, i.e., steel plates, preferably galvanised metal plates, with a corrosion-preventing plastic film or coating; roofing felt; or woven or non-woven glass fibre fleece or cloth. Also the pipe sections may be coated with: canvas, paint, plastic foil, i.e., PVC, cardboard or paper. The covering material can be impregnated with bitumen in order to be weather resistant.

The covering material can be fire resistant.

Usually pipe sections have a density from 40-400Kg/m^3, preferably 60-300Kg/m^3. The pipe sections may include support rings which are part of the insulation. Pipe sections may consist of two types of wool, one type for the pipes and another more dense type for the support rings. These support rings have the purpose for cold pipes to avoid condensation and for hot pipes to avoid thermal loss.

Pipe section support rings usually have densities from 150-400Kg/m^3 preferably 250-350Kg/m^3 and preferred around 300Kg/m^3. Wool for the remainder of the pipe section typically has density of 40-200Kg/m^3, preferably 60-180Kg/m^3.

In the invention, the preferred amount of SiO_2, MgO, CaO, FeO, alkali, TiO_2 and other elements, and the preferred viscosities and dissolution rates (at pH 4.5 and at pH 7.5) are all preferably as described in WO96/14454 and WO96/14274 and reference should be made to those. The preferred amount of Al_2O_3 is 14 to 18%. Preferably it is not more than 17.5%.

The following are examples of suitable compositions.

Composition	SiO_2	Al_2O_3	TiO_2	FeO	CaO	MgO	Na_2O	K_2O	Sintering temp	Viscosity poise 1400°C	Dissolution rate pH 4,5 nm per day
H	44,7	15,8	1,2	4,8	17,7	11,7	3,2	0,6	900	22	59
I	44,1	17,7	1,5	6,0	16,5	11,6	1,3	1,3	900	21	56
J	42,9	16,6	1,7	6,3	16,8	9,6	5,2	0,8	>1000	25	22
K	45,5	16,2	1,9	6,8	15,8	11,8	1,9	0,3	1.000	20	25
L	44,9	15,7	1,8	6,7	20,3	7,9	2,4	0,3	1.000	21	34
M	37,7	16,8	1,5	14,3	15,7	10,4	3,3	0,3	>1000	11	47

CLAIMS

1. A bonded MMVF batt suitable for use as external roof or wall cladding or as pipe sections wherein the fibres are formed of a composition which includes, by weight of oxides,

SiO_2	30 to 48%
Al_2O_3	10 to 18%
CaO	10 to 30%
MgO	2 to 20%
FeO	2 to 15%
$Na_2O + K_2O$	0 to 6%
TiO_2	0 to 6%
Other Elements	0 to 15%

and the composition has a viscosity at 1400°C of 10 to 70 poise and the fibres have a dissolution rate of at least 20nm per day when measured at a pH of 4.5

2. A batt according to claim 1 having a protective coating on its outer surface.

3. A batt according to claim 1 or claim 2 for external roof or wall cladding and having a density of 500 to 2,000 Kg/m^3.

4. A batt according to any preceding claim for external roof or wall cladding and having a dual density construction.

5. A batt according to claim 1 or claim 2 which is a pipe section including a ring of insulation of increased density.

6. Use of a bonded MMVF batt according to any of claims 1 to 4 as external roof or wall cladding.

7. A building or building component including a batt according to any of claims 1 to 4.

8. Use of a batt according to claims 1, 2 or 5 as internal or external pipe sections around pipes or pipe fittings.

9. Pipes insulated by a pipe section batt according to claims 1, 2 or 5.

INTERNATIONAL SEARCH REPORT

Inte ..onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E04D3/35 E04C2/16 E04B1/80

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E04C E04D E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 96 14274 A (ROCKWOOL INTERNATIONAL) 17 May 1996 cited in the application see page 15, line 1 - line 15; figures 3,10	1,7,9 2,6
Y	EP 0 408 428 A (ISOVER SAINT-GOBAIN) 16 January 1991 see column 3, line 39 - column 4, line 34; figures 1,2	2,6
A	GB 2 005 746 A (ROCKWOOL) 25 April 1979 see the whole document	3,4,6,7
A	US 4 917 750 A (DEUTSCHE ROCKWOOL MINERALWOLL GMBH) 17 April 1990 see column 10, line 25 - column 11, line 47; figures 4,9	5,8,9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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information on patent family members

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